



## **Evolution of surge levels inside of the Seine Bay : application to Johanna and Xynthia storms**

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Within the Technical Commission for the Study and the Evaluation of Maritime Submersions in the Seine Estuary (CteeSMES), whose aim is to improve the collective knowledge on physical processes related to maritime surge levels, a numerical model of the Seine Estuary based on TELEMAC2D has been constructed to study the evolution of surge levels from the ocean to the harbour area of Le Havre and, in particular, evaluate the amplification of the global signal and the apparition of seiches inside René Coty's basin.

The bathymetry of the model were partially provided by Le Havre and Rouen Harbours for the north-east part of the model.

The numerical model was calibrated on JOHANNA and XYNTHIA storm events, which respectively occurred in March 2008 and in February 2010. Tide propagation was firstly calibrated through the test of several tide models used at the maritime boundary and a change of the friction coefficient on the bottom. Concerning the tide calibration, numerical results were compared with the predicted tide provided at Le Havre by two softwares : PREDIT and REFMAR (SHOM). To calibrate the global signal (tide + surge levels), measurements available on ten outputs of the Seine Estuary and provided by ports of Le Havre and Rouen were used to optimize the coefficient for wind influence. Winds and pressure fields were CFSR data.

Once the numerical model of the Seine Bay had been calibrated both for tide and surge levels, it has been possible to draw the evolution of surge levels from the ocean to Le Havre (quai Meunier) and then to compare the signal obtained inside René Coty's basin. Consistently with measurements, numerical results show the apparition of an oscillating signal which adds to the signal at the entry of the Harbour. At the moment, the amplification is underestimated, and results have to be improved to represent properly the process of the seiche inside the port, near the François Ier lock.